Convertible radiator valves with pre-setting

425 - 426 - 421 - 422 series

01195/11 GB

ISO 9001 FM 21654
ISO 9001 No. 0003

Function

The convertible radiator valves with pre-setting have been designed to perform a number of functions simultaneously.
They are used for shutting off the medium on heating system terminals and are equipped with a device for pre-setting the head loss hydraulic characteristics to allow the system balancing.
In addition, by replacing the control knob, they are also fitted for thermostatic control heads and thermo-electric actuators.

The use of convertible radiator valves in combination with thermostatic control heads makes it possible to keep the ambient temperature automatically constant, at the set value, in the room where they are installed, thus guaranteeing an effective energy saving.

Patent application No. MI2007U000405 (202 series)

Reference documentation

Tech. Broch. 01009 Thermostatic control heads. 200 series
Tech. Broch. 01042 Thermo-electric actuator. 656. series.

Product range

VALVES:

For copper and simple plastic and multi-layer pipes:

425 series Angled convertible radiator valve with pre-setting ..... sizes 3/8", 1/2" radiator x 23 p.1,5 pipe
426 series Straight convertible radiator valve with pre-setting ..... sizes 3/8", 1/2" radiator x 23 p.1,5 pipe

For iron pipes:

421 series Angled convertible radiator valve with pre-setting ..... sizes 3/8" and 1/2"
422 series Straight convertible radiator valve with pre-setting ..... sizes 3/8" and 1/2"

THERMOSTATIC CONTROL HEADS AND THERMO-ELECTRIC ACTUATORS

200 series Thermostatic control head with built-in liquid-filled sensor ..... adjustment scale 0–5 corresponding to 0–28°C
201 series Thermostatic control head with remote liquid-filled sensor ..... adjustment scale 0–5 corresponding to 0–28°C
202 series Thermostatic control head with temperature indicator ..... adjustment scale 0–5 corresponding to 0–28°C
6561 series Thermo-electric actuator

Technical specifications of valves

Material

Body:	brass EN 12165 CW617N, chrome plated
Obturator control stem:	stainless steel
Hydraulic seals:	EPDM
Control knob:	ABS (RAL 9010)

Performance

Mediums:	water, glycol solutions
Max. percentage of glycol:	30%
Max. differential pressure with control fitted:	1 bar
Max. working pressure:	10 bar
Thermal medium working temperature range:	5–100°C
Factory pre-setting:	position 5

Technical specifications of 200/201/202 series thermostatic control heads

Adjustment scale:	0–5
Control temperature range:	0–28°C
Frost protection cut-in:	7°C
Max. ambient temperature:	50°C
Length of capillary pipe 201 series:	2 m
Room temperature indicator 202 series:	16–26°C

Adjustment range of 200/201/202 series thermostatic control heads

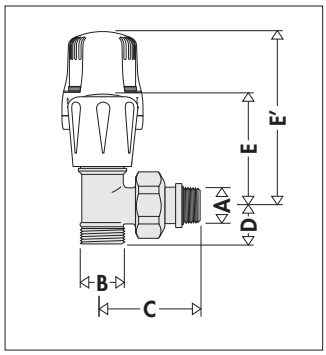
0	❄	1	2 · · · 3 · · · 4	5
OFF	7°C	12°C	16°C 20°C 24°C	28°C

Technical specifications of 6561 series thermo-electric actuators

Normally closed

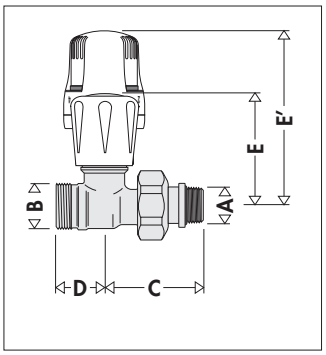
Electric supply:	230 V (ac) or 24 V (ac)/(dc)
Running power consumption:	3 W
Protection class:	IP 44 (in vertical position)
Supply cable:	80 cm

Dimensions



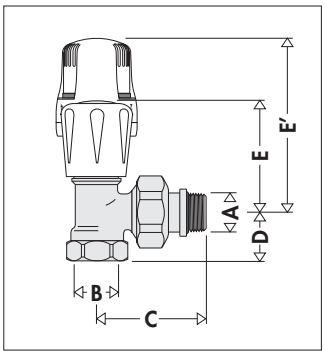
Code	A	B	C
425302	3/8"	23 p.1,5	47,5
425402	1/2"	23 p.1,5	53,5

Code	D	E	E'	Mass (kg)
425302	20,5	51,5	100	0,178
425402	20,5	51,5	100	0,210



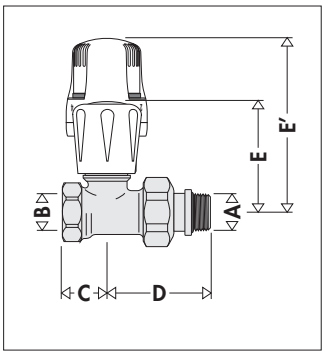
Code	A	B	C
426302	3/8"	23 p.1,5	47,5
426402	1/2"	23 p.1,5	53,5

Code	D	E	E'	Mass (kg)
426302	24	55	103	0,178
426402	24	55	103	0,210



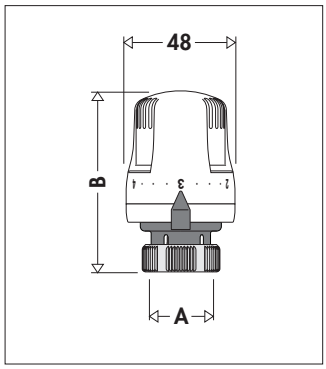
Code	A	B	C
421302	3/8"	3/8"	47,5
421402	1/2"	1/2"	53,5

Code	D	E	E'	Mass (kg)
421302	20	51,5	100	0,188
421402	23	51,5	100	0,242

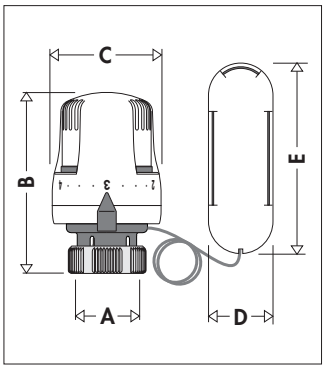


Code	A	B	C
422302	3/8"	3/8"	21
422402	1/2"	1/2"	22

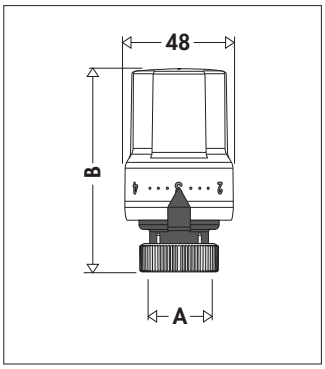
Code	D	E	E'	Mass (kg)
422302	46,5	55	103	0,188
422402	52	55	103	0,242



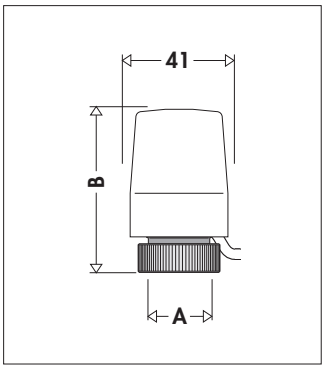
Code	A	B	Mass (kg)
200000	30 p.1,5	80	0,165



Code	A	B	C	D	E	Mass (kg)
201000	30 p.1,5	80	48	33	95	0,340



Code	A	B'	Mass (kg)
202000	30 p.1,5	85	0,168

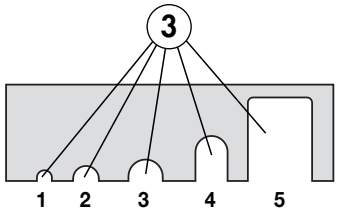


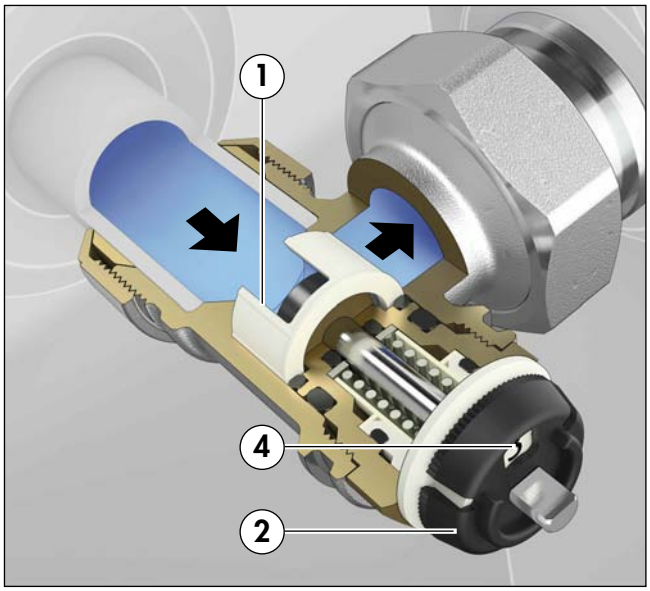
Code	A	B	Mass (kg)
65610.	30 p.1,5	62	0,19

Operating principle

The convertible radiator valves are equipped with an internal device (1) for pre-setting the head loss hydraulic characteristics.
Specific passage cross sections (3) can be selected by means of the control nut (2), in order to generate the required resistance to the motion of the medium.
Each passage cross section determines a specific Kv value for the creation of the head loss, which corresponds to a setting position on a graduated scale (4).
Depending on the position in the system, the valve can be pre-setted so as to obtain an immediate balancing of the hydraulic circuit, valid for both manual and thermostatic operation.

Flat development of the internal (1) pre-setting device

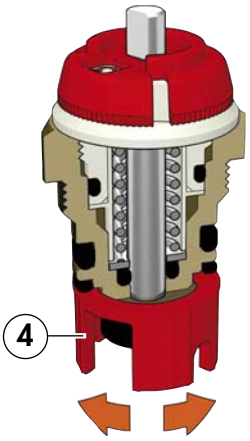




Construction details

Pre-setting of the hydraulic characteristics and system balancing

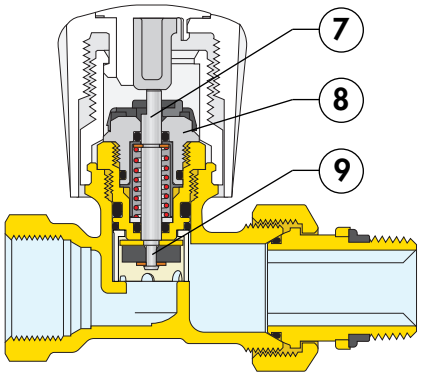
The valves are equipped with an internal device (4) that allows the pre-setting of the head loss hydraulic characteristics without the use of tools.
Therefore, with a single component, it is possible not only to shut off the circuit, as with standard valves, but also to perform the balancing of the hydraulic circuit, usually done by a lockshield valve.
This device thus makes it possible to speed up balancing operations, which are important above all when operating with simultaneous thermal loads.



Valve

The stainless steel control stem (7) has a double EPDM O-Ring seal. In this way the upper portion of the headwork (8) can be replaced even with the system running.
The obturator (9) is shaped so as to optimise the hydraulic characteristics of the valve during the progressive action of opening or closing in thermostatic operation. The wide passage between the seat and obturator causes reduced head losses in manual operation.

Convertible radiator valve with manual control



Fittability for thermostatic control heads and thermo-electric actuators

The valves are fitted for combination with thermostatic control heads (5) and thermo-electric actuators (6), for regulating the ambient temperature automatically or under a room thermostat control respectively.
Combining the valves with these devices guarantees considerable energy saving, since the ambient temperature is kept constant at the set value taking into consideration any gratuitous heat inputs (solar radiation or internal thermal loads).

Combination with systems with differential pressure regulators

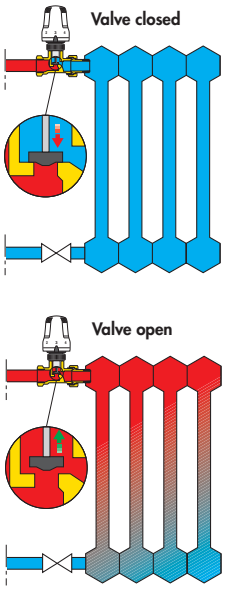
This type of valves is particularly recommended for balancing hydraulic circuits in zone independent systems or systems with risers with differential pressure regulators coupled with variable speed circulation pumps.

Combination with heat metering systems

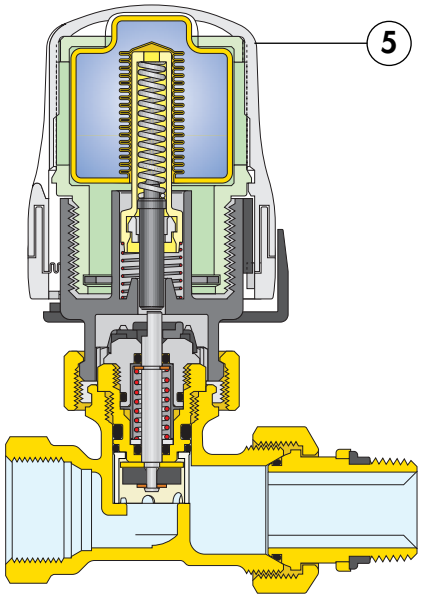
The thermostatic valves can be used in combination with metering systems.
In this way, the actual consumption of each radiator can be monitored in order to contain system running costs which, in centralised systems, can be shared in such a way to be advantageous to the end users.

Operating principle of thermostatic control head

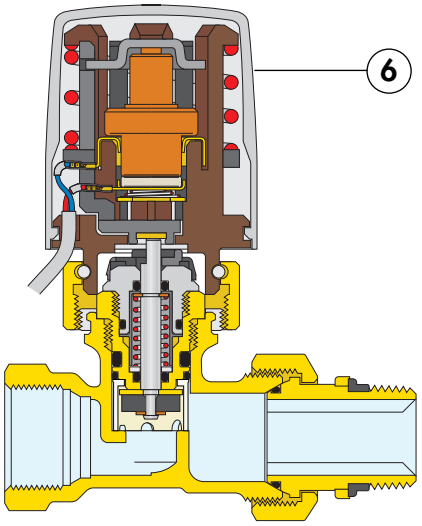
The control device of the thermostatic valve is a proportional temperature regulator, composed of a bellows containing a specific thermostatic liquid. As the temperature increases, the liquid increases in volume and causes the bellows to expand. As the temperature decreases the opposite process occurs; the bellows contracts due to the thrust of the counter spring. The axial movements of the sensor element are transmitted to the valve actuator by means of the connecting stem, thereby adjusting the flow of medium in the heat emitter.



Convertible radiator valve with thermostatic control head

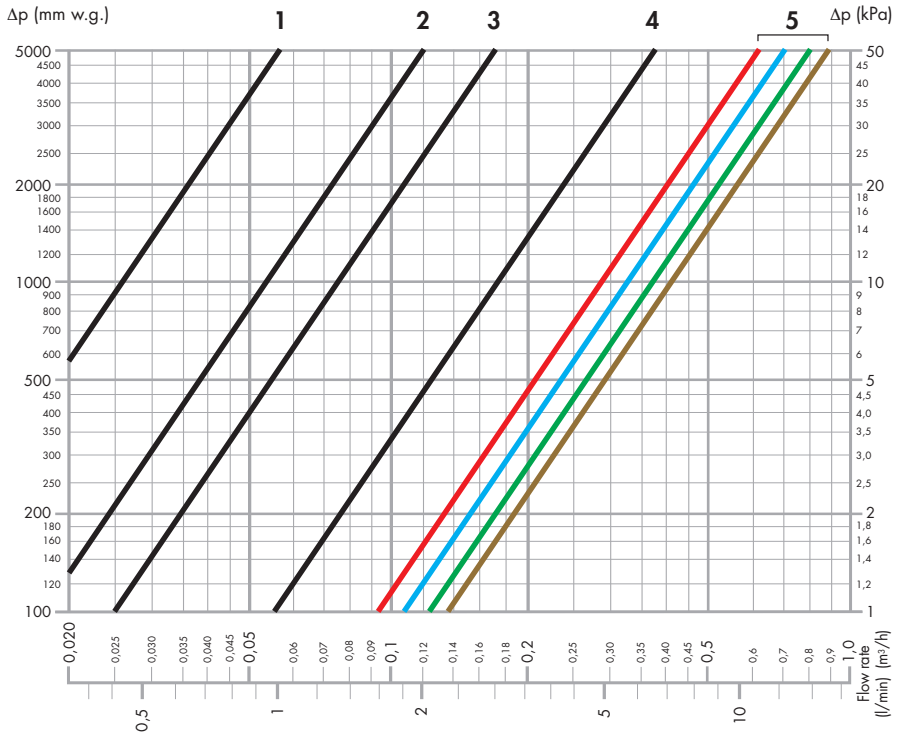


Convertible radiator valve with thermo-electric actuator



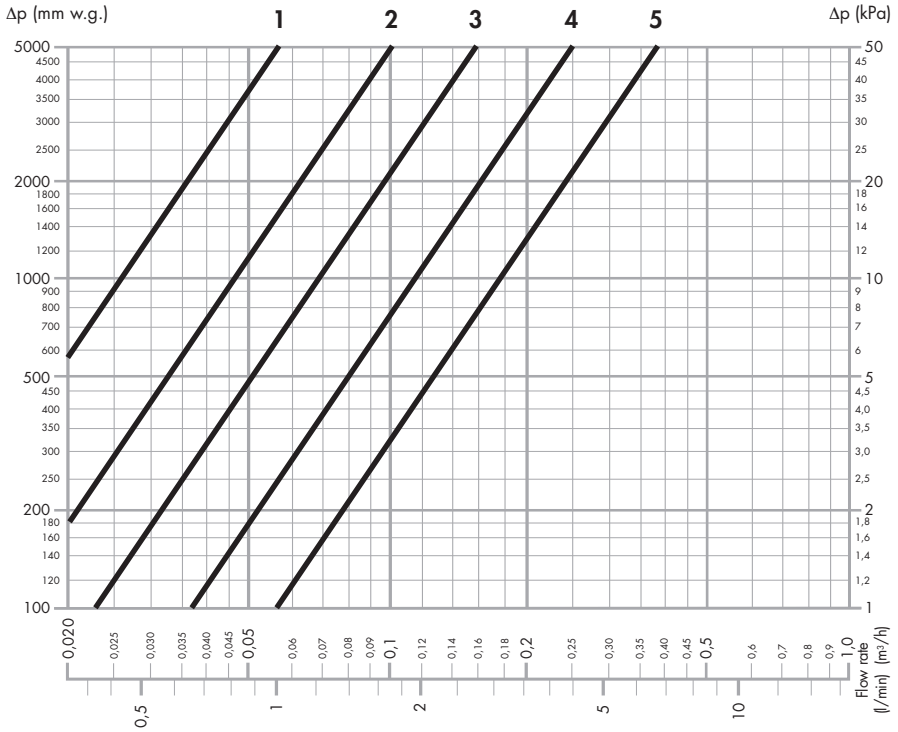
Hydraulic characteristics*

Pre-settable convertible radiator valves with manual control knob



Pre-setting position	Kvs (m³/h) 3/8" angled	3/8" straight	1/2" angled	1/2" straight
1	0,08	0,08	0,08	0,09
2	0,17	0,17	0,17	0,19
3	0,25	0,25	0,25	0,27
4	0,55	0,55	0,55	0,56
5	1,30	0,90	1,40	1,00

Pre-settable convertible radiator valves with thermostatic control head, proportional band 2K



Pre-setting position	Kv (m³/h) (Proportional band 2K)** 3/8" angled	3/8" straight	1/2" angled	1/2" straight
1	0,08	0,08	0,09	0,09
2	0,15	0,15	0,16	0,16
3	0,22	0,22	0,23	0,23
4	0,35	0,35	0,36	0,36
5	0,50	0,50	0,55	0,55

Kv = *Flow rate in m³/h that produces a head loss of 1 bar*
Kvs = *Kv with valve fully open*

***** The curves shown on the graphs are approximated on average Kv values when the actual Kv values are numerically very similar

**** Sizing of system with valves coupled to thermostatic control heads**
For a correct system sizing, the valves are normally selected by determining the head loss on the basis of the flow rate in the above diagram with 2K proportional band.

Use of the internal pre-setting (or calibration) device

The internal pre-setting device makes it possible to balance the individual circuits of the radiators in order to obtain the actual flow rates in each radiator as determined in the design stage. Let us consider each individual circuit consisting of: internal pre-setting device, pipe/radiator. In order to set the system correctly, taking into account that:

ΔP_{PD} = Circuit pre-setting device localised loss (P/R circuit flow rate)

$\Delta P_{P/R}$ = Pipe/Radiator loss (P/R circuit flow rate)

the following data must be taken into consideration:

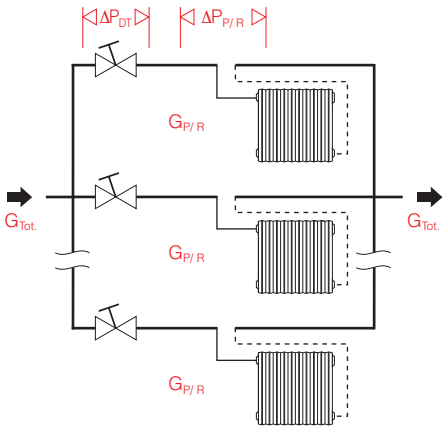
· the flow rate of the medium that must pass through each circuit (design data).

· the head loss which, for this flow rate, is generated in each circuit:

$$\Delta P_{Circuit} = \Delta P_{P/R} \quad (1.1)$$

· the head loss of the most disadvantaged circuit with the internal pre-setting device in the maximum pre-setting position (n° 5):

$$\Delta P_{Circuit} = \Delta P_{PD} + \Delta P_{P/R} \quad (1.2)$$
$$\text{+ disadvantaged}$$



In all the circuits, the pre-setting device, for the flow rate $G_{Circuit}$, must provide an additional head loss equal to the difference between the most disadvantaged circuit and the circuit in question, which we can indicate as **ΔP_{PD} (ΔP of pre-setting)**.

Once the data ΔP_{PD} and $G_{Circuit}$ have been established for each circuit, we need to refer to the graph displaying the hydraulic characteristics of the internal pre-setting device and choose the optimum regulating curve, corresponding to the pre-setting position of the valve.

Example of pre-setting calculation using angled 1/2" convertible radiator valves with pre-setting

Suppose we need to balance three circuits with head loss and flow rate characteristics for the pipe/radiator assembly showing average values calculated separately on the basis of real cases.
Since circuit No. 3 is the most disadvantaged one, because it has the greatest head loss for the pipe/radiator assembly, we must regulate the remaining circuits:

Circuit 3
$\Delta P_{P/R3}$ = 12,5 kPa
G_3 = 200 l/h

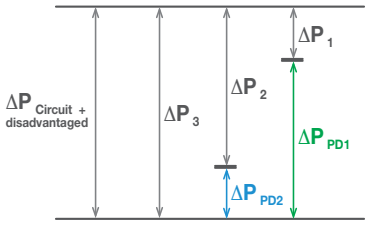
Circuit 2
$\Delta P_{P/R2}$ = 9,8 kPa *(1.1)*
G_2 = 130 l/h

Circuit 1
$\Delta P_{P/R1}$ = 3 kPa *(1.1)*
G_1 = 80 l/h

$\Delta P_{PD3} = G_3^2/{*Kvs}^2 = 200^2/140^2$ = 2 kPa

**Kvs of pre-setting device in max pre-setting position (nr. 5)*

With the formula *(1.2)*:
$\Delta P_{Circuit\ 3}$ = 2 + 12,5 = 14,5 kPa



$$\Delta P_{Circuit} = 14{,}5 \text{ kPa}$$
+ disadvantaged

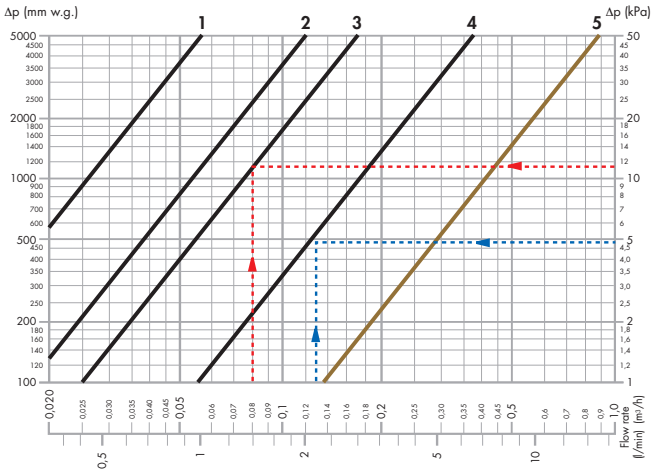
To balance circuits 1 and 2, the data we need for each circuit for reading the pre-setting position will be as follows:

Circuit 1
$\Delta P_{PD1} = \Delta P_{Circ.\ +\ disadvantaged} - \Delta P_{P/R1} =$ **14,5** - 3 = 11,5 kPa
G_1 = 80 l/h
Pre-setting position = 3*

Circuit 2
$\Delta P_{PD2} = \Delta P_{Circ.\ +\ disadvantaged} - \Delta P_{P/R2} =$ **14,5** - 9,8 = 4,7 kPa
G_2 = 130 l/h
Pre-setting position = 4*

Circuit 3
Maximum pre-setting position (nr. 5)

* *Always approximate by excess or defect to the nearest curve on the pre-setting graph.*



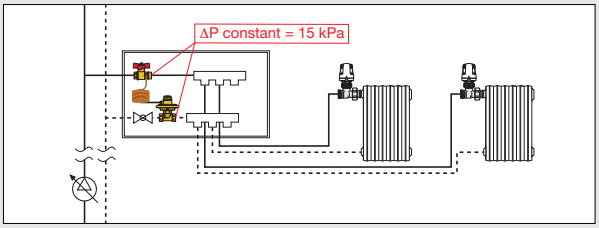
If the thermostatic control head is added, the average increase in head loss in the circuit is about 0,03 bar.

Thermostatic control heads and Δp regulators

In an operating situation in which convertible radiator valves, equipped with thermostatic control heads, are used combined with a differential pressure regulator, the valve pre-setting position is calculated with the following formula:

$$Kv_{Pre\text{-}set.} = \frac{G_{P/R}}{\sqrt{\Delta P_{Diff.\ Press\ Reg.} - \Delta P_{P/R}}}$$

$\Delta P_{P/R} = \Delta P_{Pipe} + \Delta P_{Radiator}$



(Example limited to radiators 1 and 2 only for simplicity)

$$Kv_{Pre\text{-}set.1} = \frac{0{,}080}{\sqrt{0{,}15 - 0{,}03^{**}}} = 0{,}23 \Rightarrow \text{Pos. } 3$$

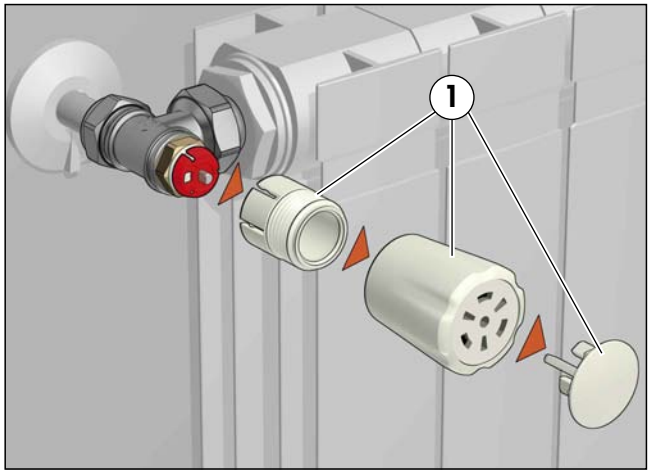
$$Kv_{Pre\text{-}set.2} = \frac{0{,}130}{\sqrt{0{,}15 - 0{,}098^{**}}} = 0{,}57 \Rightarrow \text{Pos. } 5$$

Pre-setting position	Kv (m³/h) (Proportional band 2K)** 3/8" angled	3/8" straight	1/2" angled	1/2" straight
1	0,08	0,08	0,09	0,09
2	0,15	0,15	0,16	0,16
3	0,22	0,22	0,23	0,23
4	0,35	0,35	0,36	0,36
5	0,50	0,50	0,55	0,55

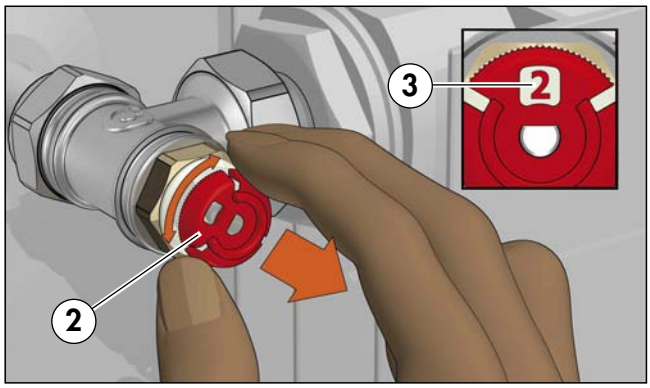
** Average values calculated separately

Pre-setting and installation of thermostatic control heads or thermo-electric actuators

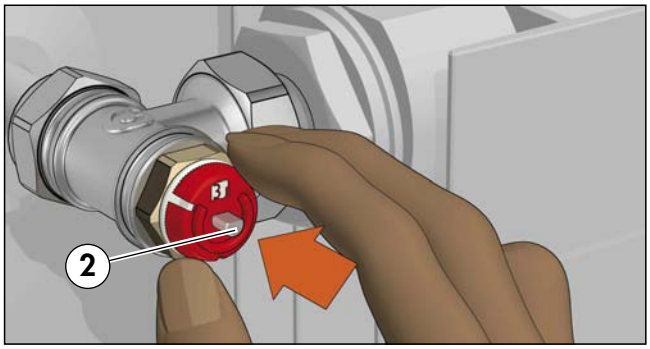
A. Remove the valve knob (1).



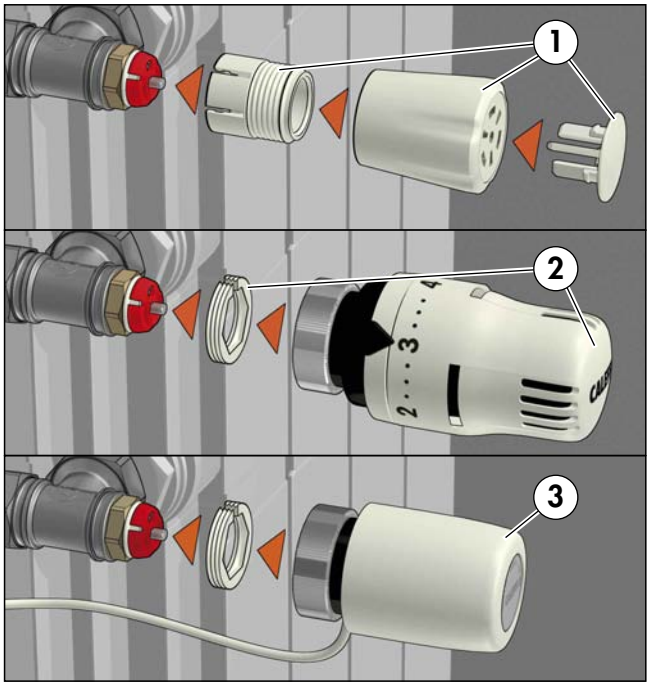
B. Lift the special control ring nut (2) of the pre-setting device and turn the control stem to select the required position. Take care not to completely remove the nut (2) from the control stem. The selected pre-setting number (3) must appear perfectly in the centre of the window.



C. Lower the ring nut (2) again.



D. Position the manual knob (1), thermostatic control head (2) or thermo-electric actuator (3) on the valve.



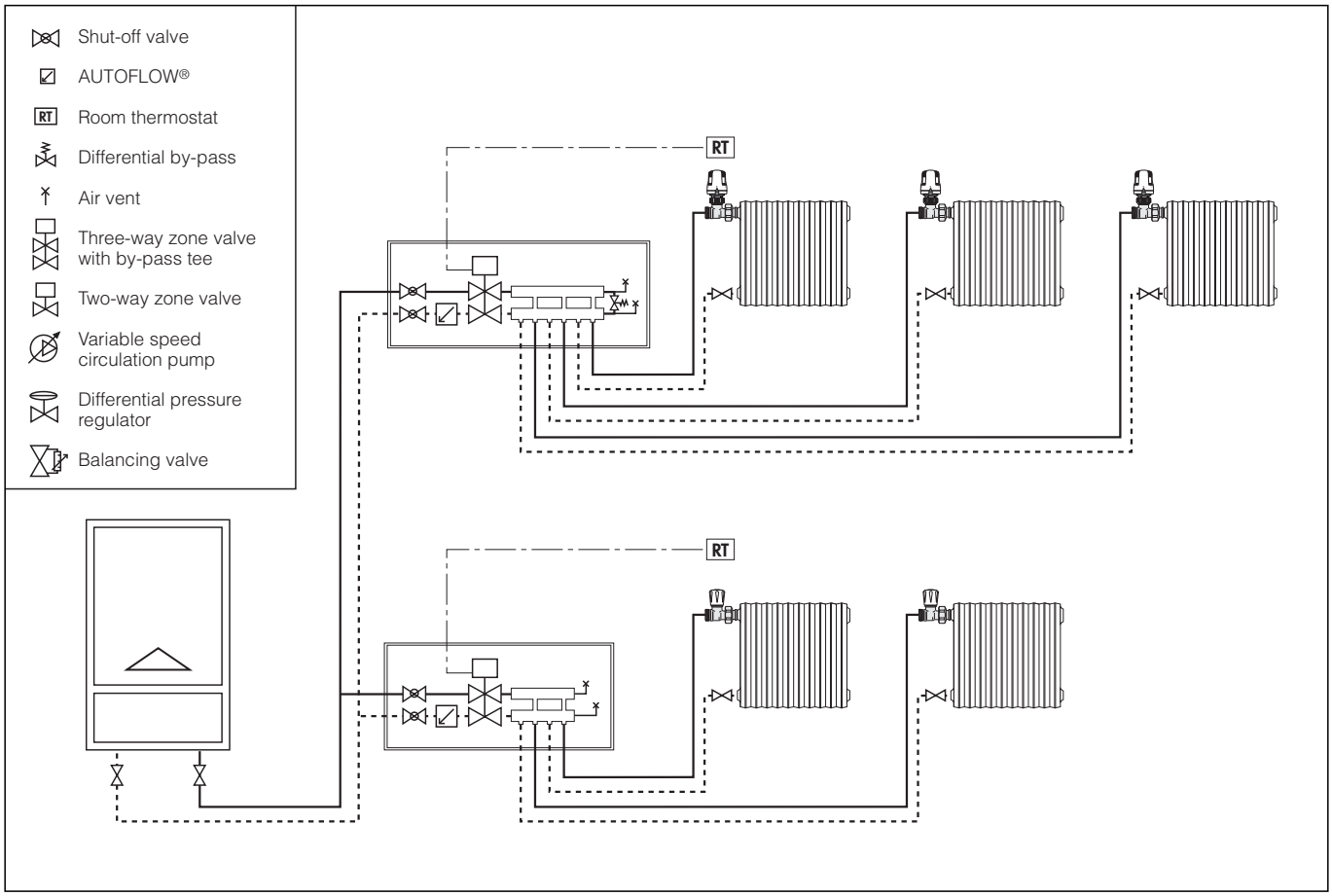
Installation of valves with thermostatic control heads

The thermostatic control heads must be installed in horizontal position.

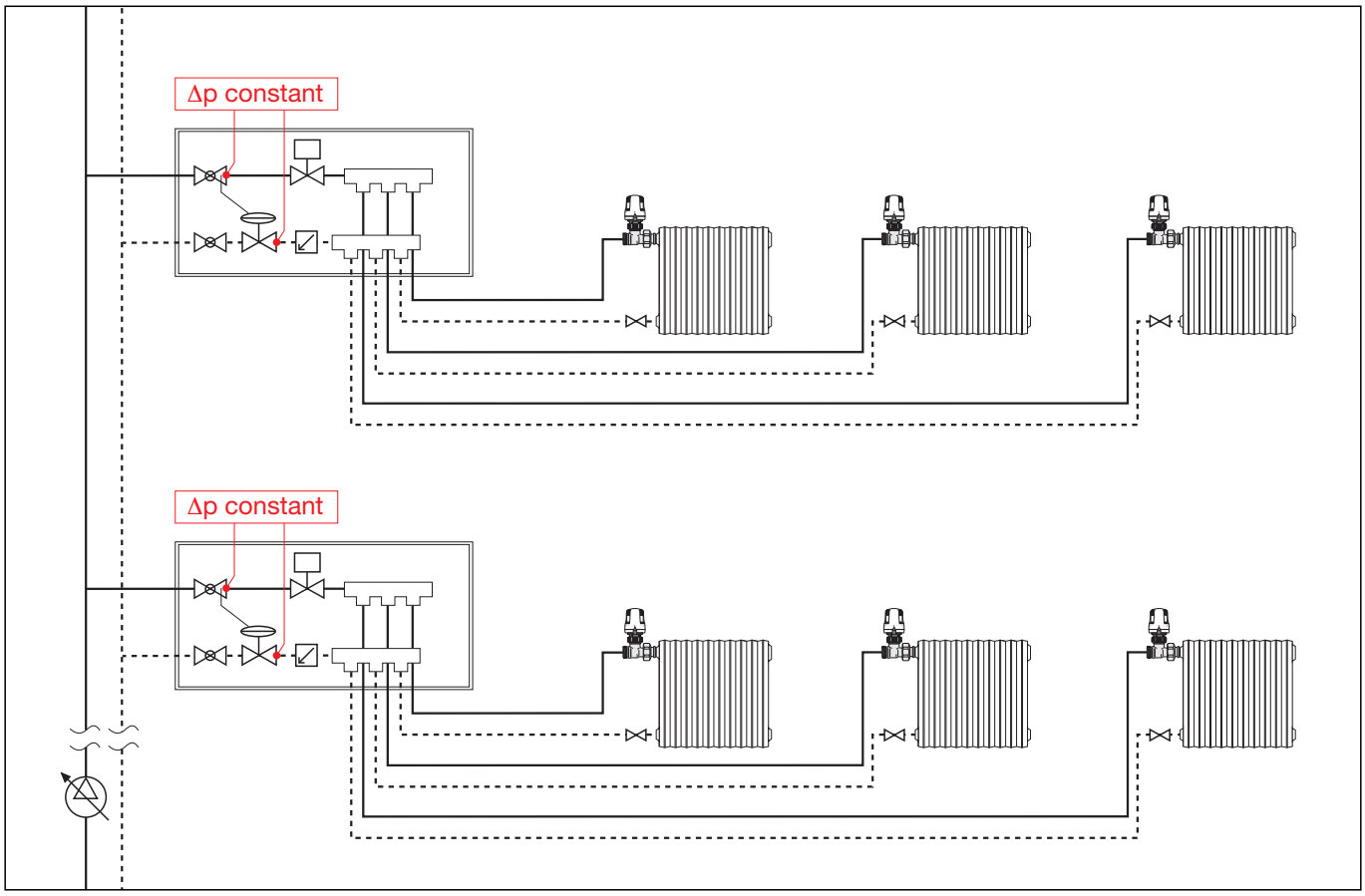
The sensible element of the thermostatic control heads must never be installed in: niches, radiator cabinets, behind curtains or exposed to direct sunlight, otherwise false readings may occur.

Application diagrams

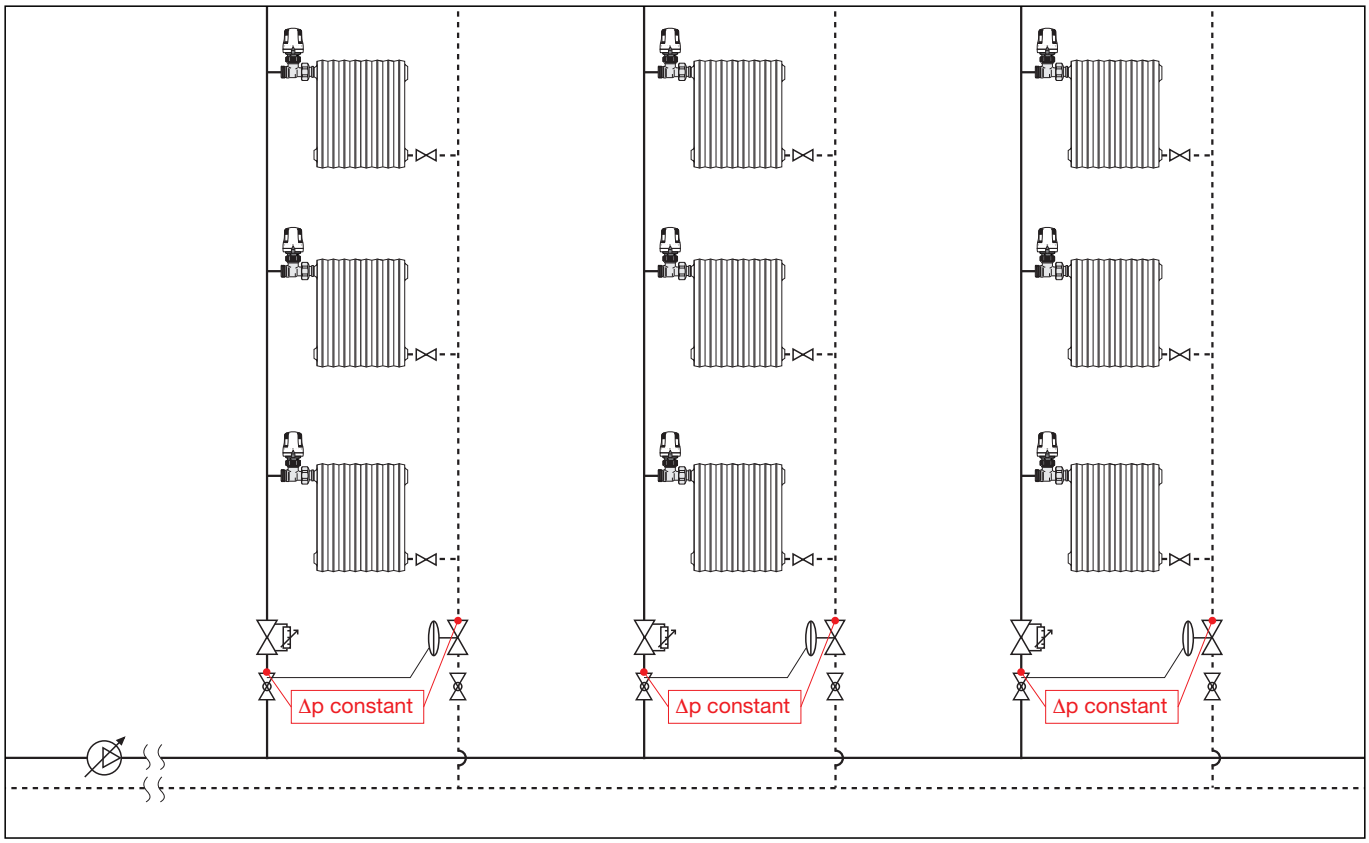
Independent system with zone valves, AUTOFLOW®, 426 series convertible radiator valves with pre-setting and thermostatic control heads



Independent zone system with thermostatic control heads, AUTOFLOW®, differential pressure regulator and variable speed circulation pump



Riser system with thermostatic control heads, balancing valves and differential pressure regulators



SPECIFICATION SUMMARIES

425 series
Convertible radiator valve with pre-setting fitted for thermostatic control heads and thermo-electric actuators. Angled connections for copper, plastic and multilayer pipes 23 p.1,5 for pipes from 10 to 18 mm. Connection to radiator 3/8" or 1/2" M with tailpiece equipped with EPDM pre-seal. Brass body. Chrome plated. White RAL 9010 ABS knob for manual control. Stainless steel control stem. Double seal on control stem with EPDM O-Ring. Thermal medium working temperature range 5–100°C. Maximum working pressure 10 bar.

426 series
Convertible radiator valve with pre-setting fitted for thermostatic control heads and thermo-electric actuators. Straight connections for copper, plastic and multilayer pipes 23 p.1,5 for pipes from 10 to 18 mm. Connection to radiator 3/8" or 1/2" M with tailpiece equipped with EPDM pre-seal. Brass body. Chrome plated. White RAL 9010 ABS knob for manual control. Stainless steel control stem. Double seal on control stem with EPDM O-Ring. Thermal medium working temperature range 5–100°C. Maximum working pressure 10 bar.

421 series
Convertible radiator valve with pre-setting fitted for thermostatic control heads and thermo-electric actuators. Angled connections for iron pipe 3/8" or 1/2" F. Connection to radiator 3/8" or 1/2" M with tailpiece equipped with EPDM pre-seal. Brass body. Chrome plated. White RAL 9010 ABS knob for manual control. Stainless steel control stem. Double seal on control stem with EPDM O-Ring. Thermal medium working temperature range 5–100°C. Maximum working pressure 10 bar.

422 series
Convertible radiator valve with pre-setting fitted for thermostatic control heads and thermo-electric actuators. Straight connections for iron pipe 3/8" or 1/2" F. Connection to radiator 3/8" or 1/2" M with tailpiece equipped with EPDM pre-seal. Brass body. Chrome plated. White RAL 9010 ABS knob for manual control. Stainless steel control stem. Double seal on control stem with EPDM O-Ring. Thermal medium working temperature range 5–100°C. Maximum working pressure 10 bar.

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